

Two medium-sized types used in the efficiency comparisons—the D.H.89 and the Airspeed Envoy. The latter is "fitted," for the purposes of the article, with Jacobs engines.

pilots, luggage and freight. By this means the elastic figure of payload, which is the proportion of the disposable load not accounted for by fuel and crew, is avoided, for, the amounts of fuel being variable indefinitely within the maximum capacity provided, there never can be a satisfactory payload figure without reference to a particular distance.

The next line of figures shows the percentage of the disposable load to the all-up weight of each machine. This is, in effect, the weight for weight ratio, so that the nearer the figure is to the 50 per cent. mark the more efficient is the design from the load-carrying point of view, as at 50 per cent. it would, as it were, be carrying its own weight. It is interesting to note how small the mean variation is between the maximum and minimum in these figures.

The next two lines are self-evident, but there is a difficulty in securing a uniform basis, as the different types have different optimum operational heights. Naturally, too, the machine can always be throttled back and this would affect the whole series of figures following below. It must be assumed, therefore, that the cruising speeds suggested by the makers, and given here as a percentage of the maximum horse-power, are those at which the various machines are best operated. This question of cruising horse-power seems to have little attention given to it in the usual sales literature, yet it is an important figure as it must react directly upon running costs.

Below is a line which shows the disposable load (defined above) in lbs. carried per horse-power used at cruising speed. This again gives a certain indication of design efficiency, and it should, of course, be read in conjunction with the cruising-speed figures. Take, for instance, the D.H.89 A Rapide's figure of 8.7 lb./h.p., and compare it with the 6.9 lb./h.p. of the Airspeed Series III. At first sight the latter appears at a disadvantage, but reference to the cruising speeds will show the former as 132 m.p.h. and the latter as 155 m.p.h. Com-

Canopus, the first of the Short Empire boats for Imperial Airways.

pare the Airspeed's 155 m.p.h. and 6.9 lb./h.p. with the D.H.86 A's 160 m.p.h. and 7.6 lb./h.p., and on this basis the advantage goes to the D.H.86.

Turn now from efficiency to economy. Here, again, the payload figure is substituted by that for disposable load and the unit of load carried is reckoned in ton/miles per hour. The resulting figure is the amount of petrol required in each case to carry a ton of disposable load over one mile for the machine in question at its given cruising speed. A load figure is taken instead of the more usual passenger-seat figure, as reflecting more accurately the differences in capacity of the various types.

For instance, the D.H.89 and the Airspeed Envoy each has the same consumption figure and the same seating capacity, but the disposable load is in favour of the Airspeed. Compare next the D.H.86 A and it is seen that the consumption for the latter is smaller, with double the seating capacity and disposable load. This is no startling result nor one that detracts from the interests of the comparative table, as it merely illustrates the obvious fact that the economy of operation when related to load increases with the size of the aircraft.

This fact, of course, is clearer still in the case of the larger machines, such as the D.C.3 and Short Empire boat. Between these last two it is interesting to note the economy in operation secured by two engines as opposed to four, even though the four are well throttled back. In such a comparison, of course, considerations of extra reliability and safety must be taken into account.

The line below gives the number of passenger seats. This appears always to be a misleading criterion of capacity, as the cubic capacity allowed per person varies as well as the space for baggage and lavatory accommodation. However, it is relevant when considering the next line of figures.

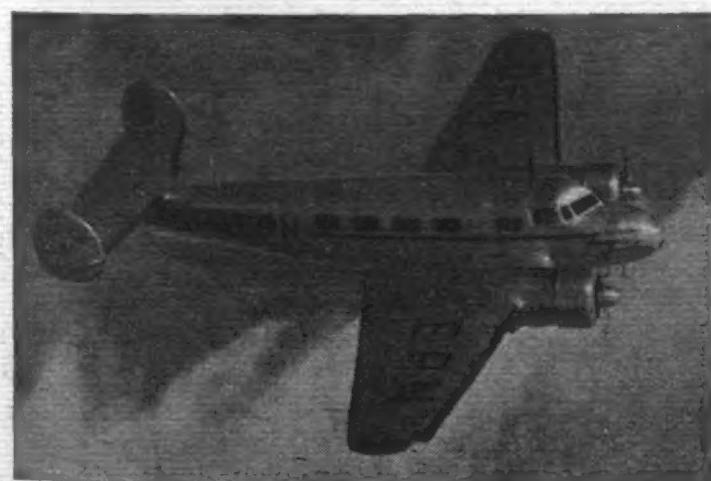
Cost-Efficiency-Capacity

These last two lines were included to take into consideration the first capital cost in its relation to the efficiency and capacity of the different machines. Thus the first line shows the capital cost per passenger seat/mile per hour. The passenger seat/mile per hour figure is derived by multiplying the number of passenger seats by the number of miles covered by the machine at its given cruising speed in one hour's flight, and this figure is divided into the capital cost to obtain a unit price. Naturally, a fixed period or distance must be taken to secure such a figure, and an hourly basis is adopted, since this makes allowance in the formula for the speed efficiency of the aircraft. Compare here the D.H.89 A. and the Airspeed III, and the lowest figure shows in favour of the former.

But, as mentioned before, the passenger seat basis is unreliable, and is shown to be so in this case, for, in fact, the Airspeed III has luggage space and a lavatory, while the D.H.89 only offers the two as alternatives when the layout of accommodation provides for six seats, so that the load figure is always to be preferred. Turning to the D.H.86 A the table shows that there is no great difference in capital cost on a passenger-seat basis with the D.H.89 A, and that on this basis the D.H.86 is actually cheaper than the Airspeed.

The last line deals again with the capital cost, but on a load basis which is exactly the same as that taken for the fuel consumption figure, but for a fixed period of one hour's flight. Turning again to the D.H.89 and the Airspeed, the figures appear lower for the former, but the difference in favour of the D.H.86 on the passenger-seat basis in the line above, as compared with the Airspeed, disappears. It seems, therefore, that although the running cost on a load basis decreases with the size of the machine, the capital cost on the same basis does not necessarily decrease.

Once the capacity and service to be offered on the route has been decided by the operator, the relative merits of various possible types can be estimated on the basis of efficiency and running economy from such a table as that described. Not



One of British Airways' Lockheed Electras.